

Linux Foundation

CKS Exam

Certified Kubernetes Security Specialist

Questions & Answers

Demo

Version: 5.0

Question: 1

Create a new ServiceAccount named backend-sa in the existing namespace default, which has the capability to list the pods inside the namespace default.
Create a new Pod named backend-pod in the namespace default, mount the newly created sa backend-sa to the pod, and Verify that the pod is able to list pods.
Ensure that the Pod is running.

**Answer: See the
Explanation below:**

Explanation:

A service account provides an identity for processes that run in a Pod.

When you (a human) access the cluster (for example, using kubectl), you are authenticated by the apiserver as a particular User Account (currently this is usually admin, unless your cluster administrator has customized your cluster). Processes in containers inside pods can also contact the apiserver. When they do, they are authenticated as a particular Service Account (for example, default).

When you create a pod, if you do not specify a service account, it is automatically assigned the default service account in the same namespace. If you get the raw json or yaml for a pod you have created (for example, `kubectl get pods/<podname> -o yaml`), you can see the `spec.serviceAccountName` field has been [automatically set](#).

You can access the API from inside a pod using automatically mounted service account credentials, as described in [Accessing the Cluster](#). The API permissions of the service account depend on the [authorization plugin and policy](#) in use.

In version 1.6+, you can opt out of automounting API credentials for a service account by setting `automountServiceAccountToken: false` on the service account:

```
apiVersion: v1
kind: ServiceAccount
metadata:
  name: build-robot
automountServiceAccountToken: false
```

...

In version 1.6+, you can also opt out of automounting API credentials for a particular pod:

```
apiVersion: v1
kind: Pod
metadata:
  name: my-pod
spec:
```

```

serviceAccountName: build-robot
automountServiceAccountToken: false
...

```

The pod spec takes precedence over the service account if both specify a `automountServiceAccountToken` value.

Question: 2

Fix all issues via configuration and restart the affected components to ensure the new setting takes effect.

Fix all of the following violations that were found against the API server:-

- Ensure the `--authorization-mode` argument includes RBAC
- Ensure the `--authorization-mode` argument includes Node
- Ensure that the `--profiling` argument is set to false

Fix all of the following violations that were found against the Kubelet:-

- Ensure the `--anonymous-auth` argument is set to false.
- Ensure that the `--authorization-mode` argument is set to Webhook.

Fix all of the following violations that were found against the ETCD:-

- Ensure that the `--auto-tls` argument is not set to true

Hint: Take the use of Tool Kube-Bench

**Answer: See the
Explanation below.**

Explanation:

API server:

Ensure the `--authorization-mode` argument includes RBAC

Turn on Role Based Access Control.

Role Based Access Control (RBAC) allows fine-grained control over the operations that different entities can perform on different objects in the cluster. It is recommended to use the RBAC authorization mode.

Fix - Buildtime

Kubernetes

`apiVersion: v1`

`kind: Pod`

`metadata:`

`creationTimestamp: null`

`labels:`

`component: kube-apiserver`

`tier: control-plane`

`name: kube-apiserver`

`namespace: kube-system`

`spec:`

`containers:`

- `command:`

+ - `kube-apiserver`

+ - `--authorization-mode=RBAC,Node`

```
image: gcr.io/google_containers/kube-apiserver-amd64:v1.6.0
livenessProbe:
  failureThreshold: 8
  httpGet:
    host: 127.0.0.1
    path: /healthz
    port: 6443
    scheme: HTTPS
  initialDelaySeconds: 15
  timeoutSeconds: 15
name: kube-apiserver-should-pass
resources:
  requests:
    cpu: 250m
volumeMounts:
- mountPath: /etc/kubernetes/
  name: k8s
  readOnly: true
- mountPath: /etc/ssl/certs
  name: certs
- mountPath: /etc/pki
  name: pki
hostNetwork: true
volumes:
- hostPath:
  path: /etc/kubernetes
  name: k8s
- hostPath:
  path: /etc/ssl/certs
  name: certs
- hostPath:
  path: /etc/pki
  name: pki
```

Ensure the `--authorization-mode` argument includes `Node`

Remediation: Edit the API server pod specification file `/etc/kubernetes/manifests/kube-apiserver.yaml` on the master node and set the `--authorization-mode` parameter to a value that includes `Node`.

```
--authorization-mode=Node,RBAC
```

Audit:

```
/bin/ps -ef | grep kube-apiserver | grep -v grep
```

Expected result:

```
'Node,RBAC' has 'Node'
```

Ensure that the `--profiling` argument is set to `false`

Remediation: Edit the API server pod specification file `/etc/kubernetes/manifests/kube-`

apiserver.yaml on the master node and set the below parameter.

```
--profiling=false
```

Audit:

```
/bin/ps -ef | grep kube-apiserver | grep -v grep
```

Expected result:

```
'false' is equal to 'false'
```

Fix all of the following violations that were found against the Kubelet:-

Ensure the --anonymous-auth argument is set to false.

Remediation: If using a Kubelet config file, edit the file to set authentication: anonymous: enabled

to false. If using executable arguments, edit the kubelet service

file /etc/systemd/system/kubelet.service.d/10-kubeadm.conf on each worker node and set the below

parameter in KUBELET_SYSTEM_PODS_ARGS variable.

```
--anonymous-auth=false
```

Based on your system, restart the kubelet service. For example:

```
systemctl daemon-reload
```

```
systemctl restart kubelet.service
```

Audit:

```
/bin/ps -fC kubelet
```

Audit Config:

```
/bin/cat /var/lib/kubelet/config.yaml
```

Expected result:

```
'false' is equal to 'false'
```

2) Ensure that the --authorization-mode argument is set to Webhook.

Audit

```
docker inspect kubelet | jq -e '[0].Args[] | match("--authorization-mode=Webhook").string'
```

Returned Value: --authorization-mode=Webhook

Fix all of the following violations that were found against the ETCD:-

- a. Ensure that the --auto-tls argument is not set to true

Do not use self-signed certificates for TLS. etcd is a highly-available key value store used by Kubernetes deployments for persistent storage of all of its REST API objects. These objects are sensitive in nature and should not be available to unauthenticated clients. You should enable the client authentication via valid certificates to secure the access to the etcd service.

Fix - Buildtime

Kubernetes

```
apiVersion: v1
```

```
kind: Pod
```

```
metadata:
```

```
  annotations:
```

```
    scheduler.alpha.kubernetes.io/critical-pod: ""
```

```
  creationTimestamp: null
```

```
  labels:
```

```
    component: etcd
```

```
    tier: control-plane
```

```
  name: etcd
```

```
  namespace: kube-system
```

```

spec:
  containers:
  - command:
+ - etcd
+ - --auto-tls=true
  image: k8s.gcr.io/etcd-amd64:3.2.18
  imagePullPolicy: IfNotPresent
  livenessProbe:
    exec:
      command:
      - /bin/sh
      - -ec
      - ETCDCTL_API=3 etcdctl --endpoints=https://[192.168.22.9]:2379 --
        cacert=/etc/kubernetes/pki/etcd/ca.crt
        --cert=/etc/kubernetes/pki/etcd/healthcheck-client.crt --
        key=/etc/kubernetes/pki/etcd/healthcheck-client.key
        get foo
    failureThreshold: 8
    initialDelaySeconds: 15
    timeoutSeconds: 15
  name: etcd-should-fail
  resources: {}
  volumeMounts:
  - mountPath: /var/lib/etcd
    name: etcd-data
  - mountPath: /etc/kubernetes/pki/etcd
    name: etcd-certs
  hostNetwork: true
  priorityClassName: system-cluster-critical
  volumes:
  - hostPath:
    path: /var/lib/etcd
    type: DirectoryOrCreate
    name: etcd-data
  - hostPath:
    path: /etc/kubernetes/pki/etcd
    type: DirectoryOrCreate
    name: etcd-certs
  status: {}

```

Question: 3

Create a PSP that will prevent the creation of privileged pods in the namespace.

Create a new PodSecurityPolicy named prevent-privileged-policy which prevents the creation of privileged pods.

Create a new ServiceAccount named psp-sa in the namespace default.

Create a new ClusterRole named prevent-role, which uses the newly created Pod Security Policy prevent-privileged-policy.

Create a new ClusterRoleBinding named prevent-role-binding, which binds the created ClusterRole prevent-role to the created SA psp-sa.

Also, Check the Configuration is working or not by trying to Create a Privileged pod, it should get failed.

**Answer: See the
Explanation below.**

Explanation:

Create a PSP that will prevent the creation of privileged pods in the namespace.

```
$ cat clusterrole-use-privileged.yaml
---
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  name: use-privileged-bsp
rules:
- apiGroups: ['policy']
  resources: ['podsecuritypolicies']
  verbs: ['use']
  resourceNames:
  - default-bsp
---
apiVersion: rbac.authorization.k8s.io/v1
kind: RoleBinding
metadata:
  name: privileged-role-bind
  namespace: psp-test
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: ClusterRole
  name: use-privileged-bsp
subjects:
- kind: ServiceAccount
  name: privileged-sa
$ kubectl -n psp-test apply -f clusterrole-use-privileged.yaml
After a few moments, the privileged Pod should be created.
```

Create a new PodSecurityPolicy named prevent-privileged-policy which prevents the creation of privileged pods.

```
apiVersion: policy/v1beta1
kind: PodSecurityPolicy
metadata:
  name: example
spec:
  privileged: false # Don't allow privileged pods!
  # The rest fills in some required fields.
```

```

seLinux:
  rule: RunAsAny
supplementalGroups:
  rule: RunAsAny
runAsUser:
  rule: RunAsAny
fsGroup:
  rule: RunAsAny
volumes:
  - '*'

```

And create it with kubectl:

```
kubectl-admin create -f example-ppsp.yaml
```

Now, as the unprivileged user, try to create a simple pod:

```
kubectl-user create -f- <<EOF
```

```

apiVersion: v1
kind: Pod
metadata:
  name: pause
spec:
  containers:
  - name: pause
    image: k8s.gcr.io/pause
EOF

```

The output is similar to this:

```
Error from server (Forbidden): error when creating "STDIN": pods "pause" is forbidden: unable to
validate against any pod security policy: []
```

Create a new ServiceAccount named psp-sa in the namespace default.

```
$ cat clusterrole-use-privileged.yaml
```

```
---
```

```

apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRole
metadata:
  name: use-privileged-ppsp
rules:
- apiGroups: ['policy']
  resources: ['podsecuritypolicies']
  verbs: ['use']
  resourceNames:
  - default-ppsp

```

```
---
```

```

apiVersion: rbac.authorization.k8s.io/v1
kind: RoleBinding
metadata:
  name: privileged-role-bind
  namespace: psp-test

```



```

roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: ClusterRole
  name: use-privileged-priv
subjects:
- kind: ServiceAccount
  name: privileged-sa
$ kubectl -n psp-test apply -f clusterrole-use-privileged.yaml
After a few moments, the privileged Pod should be created.

```

Create a new ClusterRole named prevent-role, which uses the newly created Pod Security Policy prevent-privileged-policy.

```

apiVersion: policy/v1beta1
kind: PodSecurityPolicy
metadata:
  name: example
spec:
  privileged: false # Don't allow privileged pods!
  # The rest fills in some required fields.
  seLinux:
    rule: RunAsAny
  supplementalGroups:
    rule: RunAsAny
  runAsUser:
    rule: RunAsAny
  fsGroup:
    rule: RunAsAny
  volumes:
    - '*'

```

And create it with kubectl:

```

kubectl-admin create -f example-priv.yaml

```

Now, as the unprivileged user, try to create a simple pod:

```

kubectl-user create -f <<EOF

```

```

apiVersion: v1
kind: Pod
metadata:
  name: pause
spec:
  containers:
  - name: pause
    image: k8s.gcr.io/pause
EOF

```

EOF

The output is similar to this:

```

Error from server (Forbidden): error when creating "STDIN": pods "pause" is forbidden: unable to
validate against any pod security policy: []

```

Create a new ClusterRoleBinding named prevent-role-binding, which binds the created ClusterRole

prevent-role to the created SA psp-sa.

```

apiVersion: rbac.authorization.k8s.io/v1
# This role binding allows "jane" to read pods in the "default" namespace.
# You need to already have a Role named "pod-reader" in that namespace.
kind: RoleBinding
metadata:
  name: read-pods
  namespace: default
subjects:
# You can specify more than one "subject"
- kind: User
  name: jane # "name" is case sensitive
  apiGroup: rbac.authorization.k8s.io
roleRef:
# "roleRef" specifies the binding to a Role / ClusterRole
kind: Role #this must be Role or ClusterRole
name: pod-reader # this must match the name of the Role or ClusterRole you wish to bind to
apiGroup: rbac.authorization.k8s.io

```

```

apiVersion: rbac.authorization.k8s.io/v1
kind: Role
metadata:
  namespace: default
  name: pod-reader
rules:
- apiGroups: ["" ] # "" indicates the core API group
  resources: ["pods"]
  verbs: ["get", "watch", "list"]

```

Question: 4

Given an existing Pod named test-web-pod running in the namespace test-system
 Edit the existing Role bound to the Pod's Service Account named sa-backend to only allow performing get operations on endpoints.
 Create a new Role named test-system-role-2 in the namespace test-system, which can perform patch operations, on resources of type statefulsets.
 Create a new RoleBinding named test-system-role-2-binding binding the newly created Role to the Pod's ServiceAccount sa-backend.

Answer: Send us your feedback on this.

Question: 5

Enable audit logs in the cluster, To Do so, enable the log backend, and ensure that
 1. logs are stored at /var/log/kubernetes-logs.txt.

2. Log files are retained for 12 days.
3. at maximum, a number of 8 old audit logs files are retained.
4. set the maximum size before getting rotated to 200MB

Edit and extend the basic policy to log:

1. namespaces changes at RequestResponse
2. Log the request body of secrets changes in the namespace kube-system.
3. Log all other resources in core and extensions at the Request level.
4. Log "pods/portforward", "services/proxy" at Metadata level.
5. Omit the Stage RequestReceived

All other requests at the Metadata level

Answer: See the explanation below:

Explanation:

Kubernetes auditing provides a security-relevant chronological set of records about a cluster. Kube-apiserver performs auditing. Each request on each stage of its execution generates an event, which is then pre-processed according to a certain policy and written to a backend. The policy determines what's recorded and the backends persist the records.

You might want to configure the audit log as part of compliance with the CIS (Center for Internet Security) Kubernetes Benchmark controls.

The audit log can be enabled by default using the following configuration in cluster.yml:

services:

```
kube-api:
  audit_log:
    enabled: true
```

When the audit log is enabled, you should be able to see the default values at /etc/kubernetes/audit-policy.yml

The log backend writes audit events to a file in [JSONlines](#) format. You can configure the log audit backend using the following kube-apiserver flags:

--audit-log-path specifies the log file path that log backend uses to write audit events. Not specifying this flag disables log backend. - means standard out

--audit-log-maxage defined the maximum number of days to retain old audit log files

--audit-log-maxbackup defines the maximum number of audit log files to retain

--audit-log-maxsize defines the maximum size in megabytes of the audit log file before it gets rotated

If your cluster's control plane runs the kube-apiserver as a Pod, remember to mount the hostPath to the location of the policy file and log file, so that audit records are persisted. For example:

```
--audit-policy-file=/etc/kubernetes/audit-policy.yml \
--audit-log-path=/var/log/audit.log
```